

AIR POLLUTION

New Device Measures Atmospheric Isocyanic Acid

Isocyanic acid (chemically HNCO), a contaminant linked to cataracts and heart disease, has for the first time been measured in the atmosphere.¹ The discovery was made by researchers at the National Oceanic and Atmospheric Administration (NOAA) who designed a new detection system to measure HNCO in environments where conventional methods could not previously detect it.

Study leader James Roberts and colleagues developed a specialized negative-ion proton-transfer chemical ionization mass spectrometer to measure organic acids emitted by wildfires² [look for more information on health effects of wildfires in the September 2011 issue of *EHP*]. They tested the instrument on brush and tree branches burned in a test chamber, which generated levels of HNCO reaching 600 ppbv. Next they used the device on air samples collected in Boulder, Colorado, during the 2010 Fourmile Canyon wildfire and ambient air samples collected in downtown Los Angeles, California. These samples yielded HNCO concentrations up to 200 pptv and 100 pptv, respectively. No wildfires were burning near Los Angeles at the time, so “we assume isocyanic acid came from vehicle exhaust or photochemical reactions known to make it,” Roberts says.

The investigators also observed HNCO in laboratory samples of cigarette smoke but noted “the levels were too high for us to quantify with the...instrument configured in the ambient measurement mode.” Drawing on a surrogate pyrolysis study that found nearly all the urea in tobacco decomposes to HNCO during burning,³ the researchers calculated mainstream cigarette smoke may contain 40–140 ppmv HNCO.¹ Urea is added to cigarettes to enhance flavor.

Urea is also used in selective catalytic reduction systems to break down toxic nitrogen oxides (NO_x) in diesel exhaust into nitrogen and water. Roberts wants to measure HNCO emitted by these systems, which the European Union mandates for heavy-duty diesel trucks; a similar law is pending in California.⁴ “In trying to solve the problem of NO_x we could be increasing HNCO,” Roberts says.

The health effects of chronic exposure to environmental HNCO are unknown, although Roberts and colleagues note the concentrations they measured in smoke “cause carbamylation at physiologically significant levels.”¹ In carbamylation, cyanate binds the amino acid lysine in proteins to form homocitrulline. Stanley Hazen, section head of Preventive Cardiology and Rehabilitation at the Cleveland Clinic, found that high blood levels of homocitrulline are a strong predictor of heart disease, especially in smokers, offering a possible mechanism linking smoking to atherosclerosis.⁵

“We assumed the exogenous source of cyanate in our study was smoking,” Hazen says. Now Roberts’ study suggests HNCO from air pollution also may increase cardiovascular disease risk. “Any degree of carbamylation has potential to be harmful,” Hazen says, although the levels required to raise cardiac and other health risks remain to be determined.

Carol Potera, based in Montana, has written for *EHP* since 1996. She also writes for *Microbe*, *Genetic Engineering News*, and the *American Journal of Nursing*.

REFERENCES

1. Roberts JM, et al. Isocyanic acid in the atmosphere and its possible link to smoke-related health effects. *Proc Natl Acad Sci USA* 108(22):8966–8971 (2011); <http://dx.doi.org/10.1073/pnas.1103352108>.
2. Burling R, et al. Laboratory measurements of trace gas emissions from biomass burning of fuel types from the southeastern and southwestern United States. *Atmos Chem Phys Discuss* 10(7):16425–16473 (2010); <http://dx.doi.org/10.5194/acpd-10-16425-2010>.
3. Baker RR, Bishop LJ. The pyrolysis of tobacco ingredients. *J Anal Appl Pyrol* 71(1):223–311 (2004); [http://dx.doi.org/10.1016/S0165-2370\(03\)00090-1](http://dx.doi.org/10.1016/S0165-2370(03)00090-1).
4. California ARB. Heavy Duty Vehicle Selective Catalytic Reduction Technology Field Evaluation. Sacramento, CA: California Air Resources Board (May 2011). Available: <http://tinyurl.com/43p3d6r> [accessed 14 Jul 2011].
5. Wang Z, et al. Protein carbamylation links inflammation, smoking, uremia, and atherogenesis. *Nature Med* 13(10):1176–1184 (2007); <http://dx.doi.org/10.1038/nm1637>.

The Beat

by Erin E. Dooley

EPA Rule Targets Smokestack Pollution

In July 2011 the U.S. EPA finalized the Cross-State Air Pollution Rule to reduce SO₂ and NO_x emissions from power plants using available emissions control technologies.¹ SO₂ and NO_x contribute to ground-level ozone and fine particle pollution and often cross state lines, ending up far from their provenance. The rule is projected to achieve up to \$280 billion in annual health benefits by preventing avoidable illnesses, sick days at work, and premature deaths. Within three years the rule is expected to help reduce SO₂ emissions by 73% and NO_x emissions by 54% over 2005 levels.

Extremotolerant Fungi Isolated in Dishwashers

Dishwasher interiors are extreme environments featuring high temperatures, high pH, and high salinity, supplemented by high organic content from the dirty dishes. A study of households on six continents has found



several species of potentially pathogenic “extremotolerant” fungi growing in the rubber seals on household dishwashers.² The most commonly isolated fungi were *Exophiala* species, which can colonize the lungs of patients with cystic fibrosis and

occasionally cause fatal infections in healthy humans; these were found in over half the dishwashers sampled.

Japan Struggles with Debris from Tohoku Disaster

The Japanese prefectures affected by the March 2011 Tohoku earthquake and tsunami are struggling to recover, but the infrastructure for disposing of an estimated 21.83 million tons of debris is not yet available. According to Japanese news service Asahi Shimbun, some 35% of the disaster debris has been moved to temporary dump sites in an effort to clear space for rebuilding.³ The land around Ishinomaki Commercial High School in Miyagi Prefecture is the site of a dusty, foul-smelling dump for more than 100,000 tons of concrete, wood, household goods, and tsunami sludge contaminated with unquantified chemical agents.⁴ Students and staff at the school are reporting respiratory effects and eye irritation they attribute to the dump.³

SMOKING AND SECONDHAND SMOKE

Hookahs: Hot and Hazardous

Hookah cafes are an increasingly popular venue for socializing. In addition to beverages, appetizers, and desserts, habitués can order different flavors of tobacco that they smoke through waterpipes. Many patrons of hookah cafes believe smoking a waterpipe is safer than smoking cigarettes—an unsubstantiated belief “as old as the waterpipe itself,” according to the World Health Organization.¹ A new field trial shows that carbon monoxide (CO) levels were 3 times higher in people visiting hookah cafes than in people who visited traditional bars.²

Tracey Barnett, a social and behavioral scientist at the University of Florida, Gainesville, and colleagues measured CO levels of 173 patrons leaving three local hookah cafes and 198 patrons leaving five traditional bars that allow smoking. Hookah cafe patrons had an average CO level of 30.8 ppm compared with 8.9 ppm for traditional bar patrons. Even hookah cafe patrons who did not smoke from the waterpipe had average elevated CO levels of 11.5 ppm, similar to cigarette smokers.²

The Occupational Safety and Health Administration established a cutoff of 50 ppm for CO exposure over an 8-hour period;³ 18% of hookah cafe patrons had CO levels exceeding this level, and 5% tested above 90 ppm.² Symptoms of CO poisoning such as lightheadedness and nausea start at about 70 ppm.⁴ Some hookah smokers claim they experience a “high,” but “they’re probably in the early stages of CO poisoning,” Barnett says. Emergency rooms have reported visits for CO poisoning after hookah smoking.^{5,6,7}

Hookah smoke contains toxicants not only from burning tobacco but also from the charcoal used to heat the tobacco in the pipe’s bowl, including CO, heavy metals, and polycyclic aromatic hydrocarbons.⁸

Shared hookahs also can raise the risk for communicable diseases.⁹ The water in a waterpipe does absorb some nicotine, so hookah smokers may inhale more smoke seeking a satisfying amount of the drug.¹ A hookah session typically lasts 20–80 minutes, and the number and depth of puffs taken means a patron may inhale the smoke equivalent of 100 or more cigarettes.¹

Hookah cafes are popular in university towns and large cities. By one 2005 estimate, up to 20% of some U.S. populations of young adults engage in hookah smoking.¹⁰ Norman Edelman, chief medical officer at the American Lung Association, says his organization is working with states to pass laws to ban hookah smoking. “People realize more and more that this is a dangerous practice,” Edelman says.

Carol Potera, based in Montana, has written for EHP since 1996. She also writes for *Microbe*, *Genetic Engineering News*, and the *American Journal of Nursing*.

REFERENCES

1. WHO Study Group on Tobacco Product Regulation (TobReg). Advisory Note. Waterpipe Tobacco Smoking: Health Effects, Research Needs, and Recommended Actions by Regulators. Geneva, Switzerland:World Health Organization (2005). Available: <http://tinyurl.com/g27zw> [accessed 14 Jul 2011].
2. Barnett TE, et al. Carbon monoxide levels among patrons of hookah cafes. *Am J Prev Med* 40(3):324–328 (2011); <http://dx.doi.org/10.1016/j.amepre.2010.11.004>.
3. OSHA. Occupational Safety and Health Guidelines for Carbon Monoxide [website]. Washington, DC:Occupational Safety & Health Administration, U.S. Department of Labor. Available: <http://tinyurl.com/4pbz4z> [accessed 14 Jul 2011].
4. CPSC. Carbon Monoxide Questions and Answers, CPSC Document #466 [website]. Bethesda, MD:U.S. Consumer Product Safety Commission (updated 13 Jul 2011). Available: <http://tinyurl.com/338p85> [accessed 14 Jul 2011].
5. Cavus UY, et al. Carbon monoxide poisoning associated with narghile use. *Emerg Med J* 27(5):406 (2010) <http://dx.doi.org/10.1136/emj.2009.077214>.
6. Lim BL, et al. Case of carbon monoxide poisoning after smoking shisha. *Int J Emerg Med* 2(2):121–122 (2009); <http://dx.doi.org/10.1007/s12245-009-0097-8>.
7. Uyanik B, et al. Narghile (hookah) smoking and carboxyhemoglobin levels. *J Emerg Med* 40(6):679 (2011); <http://dx.doi.org/10.1016/j.jemermed.2009.05.032>.
8. Shihadeh A, Saleh R. Polycyclic aromatic hydrocarbons, carbon monoxide, “tar,” and nicotine in the mainstream smoke aerosol of the narghile water pipe. *Food Chem Toxicol* 43(5):655–661 (2005); <http://dx.doi.org/10.1016/j.fct.2004.12.013>.
9. Knishkowsky B, Amitai Y. Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics* 116(1):e113–e119 (2005); <http://dx.doi.org/10.1542/peds.2004-2173>.
10. Cobb C, et al. Waterpipe tobacco smoking: an emerging health crisis in the United States. *Am J Health Behav* 34(3):275–285 (2010).

NIH Funds Oil Spill Health Effects Study

In July 2011 the NIH announced a new five-year, \$25.2-million project to conduct research on health effects of the BP *Deepwater Horizon* disaster of 2010.⁵ Led by the NIEHS, the project will support population-based and laboratory studies at four Gulf Coast universities. The universities will partner with community organizations to incorporate local concerns into study designs and communicate findings of the research. Each university also will implement a community resilience program to study factors that affect how well individuals, households, and communities adapt to events such as the *Deepwater Horizon* disaster. The findings will be used to help improve capacity to respond to future disasters.

House Passes Amendment to Block Approval of GE Salmon

The U.S. House of Representatives has passed an amendment to the Fiscal Year 2012 Appropriations bill for the FDA⁶ that would



prohibit the agency from using federal funds to approve AquaBounty® salmon, a genetically engineered fish designed to grow faster than conventional salmon.⁷ The amendment was introduced by Representative Don Young (R-AK), who argued the AquaBounty salmon could threaten wild salmon populations and

lower the price of their wild counterparts. Other supporters cited the lack of long-term studies on the safety of eating genetically engineered fish. The bill now awaits action by the Senate Appropriations Committee.

REFERENCES

1. EPA. EPA Reduces Smokestack Pollution, Protecting Americans' Health from Soot and Smog/Clean Air Act Protections Will Cut Dangerous Pollution in Communities That Are Home to 240 Million Americans [press release]. Washington, DC:U.S. Environmental Protection Agency (7 Jul 2011). Available: <http://tinyurl.com/3f4onpb> [accessed 15 Jul 2011].
2. Zalar P. Dishwashers—a man-made ecological niche accommodating human opportunistic fungal pathogens. *Fungal Biol*; <http://dx.doi.org/10.1016/j.funbio.2011.04.007> [online 7 May 2011].
3. 4 Months On, Disaster Debris Still a Huge, Smelly Problem. *Asahi Shimbun* (9 Jul 2011). Available: <http://tinyurl.com/3uohbb9> [accessed 15 Jul 2011].
4. Bird WA, Grossman E. Chemical aftermath: contamination and cleanup following the Tohoku earthquake and tsunami. *Environ Health Perspect* 119(7):A290–A301 (2011); <http://dx.doi.org/10.1289/ehp.a290>.
5. NIEHS. NIH-funded Research Network to Explore Oil Spill Health Effects [press release]. Research Triangle Park, NC:National Institute of Environmental Health Sciences, National Institutes of Health. Available: <http://tinyurl.com/6bcw2dt> [accessed 15 Jul 2011].
6. Amendment 50 to H.R. 2112, Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2012, U.S. House of Representatives. Available: <http://tinyurl.com/3rencce> [accessed 15 Jul 2011].
7. Taylor DA. Genetically engineered salmon on the FDA's table. *Environ Health Perspect* 118(9):a384–a385 (2010); <http://dx.doi.org/10.1289/ehp.118-384a>.